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# Household ecological footprints – moving towards sustainability?

What are the main environmental impacts of UK households, and how sustainable are they? **Robin Roy** and **Sally Caird** report on a major study, based on the ecological footprint technique, of the environmental impacts of nearly 700 representative British households

Households account for about a third of the energy delivered and a quarter of greenhouse gas emissions generated in the UK. If personal transport is included, households account for about half of all UK energy consumption, and so are a very significant source of greenhouse gas emissions, as well as hazardous air pollution and other environmental effects.<sup>1</sup>

In addition to direct energy use for heating, cooking, fuelling cars, etc., households use energy and other resources indirectly through the purchase of goods and services. It is more difficult to estimate this indirect consumption, but one study indicates that the indirect energy consumption of Dutch households represented nearly 60 per cent of the total household energy requirement.<sup>2</sup> The largest source of indirect energy and resource use was the production, processing, distribution, and consumption of food.

Of course, the demands that households place on the environment vary depending on factors such as the number and ages of the occupants and their lifestyles, income, and aspirations. However, the demands that households in the industrialised world place on the environment have generally increased, as incomes and living standards have risen. This is due to a number of related factors, the main ones being the growth in demand for transport and the growth in household consumption of goods and services.

But social factors are also involved – in particular, household size has fallen. Average household size in the UK has fallen from three persons in 1960 to 2.5 in 1991, and nearly a third of the UK population now live in single-person households.<sup>3</sup> This trend has attracted much planning attention regarding where the required new

homes may be located. Moreover, declining household size increases other environmental impacts, because each of the additional homes has to be furnished, heated, and equipped with appliances.

### **Ecological footprints**

It is often said that this pattern of growing household consumption is not sustainable; but is there a way of determining the extent to which this is so? One technique that attempts to assess the degree to which a given population can be supported from available resources is the 'ecological footprint'.

The ecological footprint (EF) is an environmental indicator originally developed by William Rees and Mathis Wackernagel in the early 1990s,<sup>4</sup> which has since been considerably refined. The EF is a measure of the area of land (of world average biological productivity) required to indefinitely provide the resources for, and to absorb the pollution and wastes of, a particular population with a given lifestyle and level of technology.<sup>5</sup>

For example, using 1996 data it has been calculated that the land required to supply food, water, and forest products, [\[COMMA\]](#) to accommodate the buildings, roads, etc., and to absorb the carbon dioxide and wastes produced by an average American living their current lifestyle was over 12 hectares per person. This compares with about 6 hectares for an average Briton and 1 hectare per capita for an average Indian. For the UK the total footprint per head of the population is estimated at about 3.5 times the country's biologically productive per capita land capacity.<sup>6</sup>

Similar calculations indicate that the OECD industrialised countries need to halve their present average EF of 7.2 hectares per person if they are to live sustainably within their countries' bio-productive capacity. And to move towards a globally equitable and sustainable footprint – an 'earthshare', or equal share of the world's bio-productive land capacity – the footprint of the average OECD inhabitant would have to be reduced by over two-thirds. Globally, the world average footprint has been calculated as 2.85 hectares per person, compared with an estimated biologically productive land capacity of 2.0 hectares per person. This 'overshoot' is said to result in

a depletion of the earth's natural capital stock and so, arguably, is not sustainable.<sup>6</sup>

Although EF analysis is a simplification of a very complex situation, it gives some idea of the extent to which any country, region, city, or household is sustainable from its own productive land (or an equal share per head of the world's land) at a given level of technology.

### Footprinting UK households

The figures given above are for the total EF per person, considering not only household impacts but also a proportion allocated to each person to cover the activities of industry, commerce, and government. But, given the importance of households to environmental impacts, what can and needs be done at the household level to move towards sustainability?

One approach is to provide a simple way of enabling consumers to assess the environmental impact of their households, and so raise awareness and encourage environmentally responsible lifestyles. That was the aim behind a computer program called EcoCal, originally developed in 1997 by Best Foot Forward<sup>7</sup> for the UK 'Going for Green' environmental awareness campaign. EcoCal calculates the ecological footprint of a given household from data about its consumption in six areas – transport, energy, water, shopping, land occupied by [INSERT OK? YES] house and garden, and waste – and makes suggestions for reducing the footprint.

Strictly speaking, EcoCal does not directly provide an EF but gives its results in 'ecocalories', where 100 ecocalories equates to an EF of 1 hectare. This measure, with its analogy to food calories and dieting, was thought to be more comprehensible to the public than the ecological footprint. A paper questionnaire version of EcoCal was produced for those without a computer.

This article gives some results from the largest study of UK household ecological footprints so far conducted. The 692 households surveyed all included a member who took an Open University (OU) introductory environment course called *Working with our Environment* during 2000. The first part of the course involved students using EcoCal to obtain their household's EF in the above six areas, together

with a total household footprint score, and to suggest ways of reducing their scores.<sup>8</sup>

Since OU students are mature, often with experiences of employment and parenthood, and their households are similar in size and composition to British averages, the results should be fairly representative of UK households.

Our study shows that the average EF per OU household (containing an average of 2.1 adults and 0.8 children under 16 years of age) is 3.34 hectares, or 1.33 hectares per person including children. These findings are very similar to those of another household footprint study that used EcoCal. That study of 42 UK households, also averaging 2.9 occupants and representing a variety of socio-economic types, produced an average household footprint of 3.6 hectares, or 1.24 hectares per person.<sup>5,p.165</sup>

### **Footprints of different household types**

We also examined the differences between the OU households with children under 16 years old and those without, between the urban/suburban and rural households, and between households of different sizes. This analysis produced some interesting results.

Perhaps not surprisingly, households without children had higher footprints per person than those with children, since younger children generally use fewer resources than adults and older children. In particular, households without children have much higher footprints for transport by car, bus, train and air, averaging nearly 0.72 hectares per person, than those with children, at 0.26 hectares per person. This is a statistically significant difference, and is probably due to higher disposable incomes of households without children allowing for more travel, the freedom from the commitments associated with younger children, and possibly greater commuting distances.

Households without children also had significantly higher average energy footprints, at 0.59 hectares per person, than those with children, at 0.35 hectares per person. It is more difficult to explain why adult households and households with older children use more heating and electricity per head than householders with younger children, since one would expect the latter to spend more time at home. It is probably due to more electrical appliances in households

accommodating older teenagers and the larger living space per person of childless households and households whose children have left home.

Households without children also had twice the average footprint for shopping, at 0.14 hectares per person, than households with children, at 0.07 hectares per person. This is probably explained by the economies of food shopping in households catering for younger children. Adult households and those with older children are likely to spend more per person on food, as well as on other goods.

In terms of the differences between the urban/suburban and rural households, as expected given the lack of public transport and the longer journey distances for those living outside towns, rural households had higher average transport footprints, at 0.58 hectares per person, than urban households, at 0.47 hectares per person. Adult rural households, including those with older children, had the largest transport footprints of all, at 0.75 hectares per person. Rural households, again not surprisingly, had over twice the footprint per person for the area occupied by house and garden of the urban households.

Such differences were reflected in variations in the relative contribution of transport, shopping, etc. to the total household footprint per person. Transport and energy were the most important components of the EF in all cases, together accounting for three-quarters of the total. Shopping for food and some other goods, land for the house and garden, and waste disposal each counted for some 8 per cent, while water consumption only accounted for 1 per cent of the total footprint per person. Although EcoCal waste and water footprints are now recognised as underestimates,<sup>5,p.167</sup> our results reinforce the conclusion of many other studies that transport and energy are the key issues to tackle first.

But there were variations in the 'polluting profiles' (see the graphs [above](#)). For households without younger children, transport had greatest impact, while for households with children energy was the largest component of the EF. Likewise, the per capita transport footprint was (just) the greatest contributor for urban households, while energy was the largest component of rural household footprints.

Such differences, while not surprising, suggest that policies designed to reduce environmental impacts from households may need to be targeted [to AT?] different groups in the population or even to different locations. For example, it is clear that, in our sample, rural households comprising all adults or adults plus older children have the largest per capita footprints of all, especially for transport and energy consumption – twice that of urban households with younger children.

One of the most interesting statistical findings was the effect of household size on EcoCal-derived footprints. There was a decline in the total and in most component footprints per person as households got larger, and especially as size grew from single- and two-person to three-, four-, or more-person households. It may seem that this reduction only relates to households with two or more children; but the decline also applied to households with all adults or adults plus older children. This finding reinforces other work that has shown the highly negative effect on the environment, especially concerning energy consumption, personal transport, and land for housing, of the shift to ever smaller households.

### **Towards sustainable households**

A trend towards higher household consumption per person also raises a key issue posed by ecological footprinting – namely the degree to which a given population is sustainable from its own, or the world's, resources.

It is roughly estimated that a sustainable UK household ecological footprint (as measured by EcoCal) is about 0.4–0.5 hectares per person.<sup>9</sup> This contrasts with the average OU household footprint of about 1.3 hectares per person. If we accept these estimates, some 4–10 per cent of the OU households could be regarded as sustainable. Most of the OU households that achieved a 'sustainable' footprint did so by having much lower than average impacts per person in all areas, but especially in transport. Given their very low transport footprints, it is likely that some of these sustainable households travel mainly by cycling or walking.

Although our findings indicate that sustainability *can* be achieved in current society, the majority of our sample households had footprints well above the sustainability targets. An average OU

household would have to reduce its footprint by 60–70 per cent to achieve sustainability.

Again there are some hopeful signs, given what some of these OU students said they planned to do to reduce their household's footprint. Most realised how important it is to try to reduce transport and energy consumption and proposed practical ideas for how to do this, such as car-sharing with neighbours, avoiding long-haul flights, installing low-energy lighting, and replacing electric cookers with gas. Many were also prepared to contemplate more radical options for the longer term – for example working more from home, installing a condensing boiler, and shifting to 'green electricity'; and a few even suggested moving house to reduce their transport needs.

Evidence that at least some of the students actually implemented their ideas for reducing household footprints came from an environmental audit of the course. These and other environmentally responsible changes in behaviour were mentioned as an important outcome of the course.<sup>10</sup>

But despite signs of progress towards sustainability among environmentally aware householders, it is necessary to recognise the very large task involved in bringing about changes in the lifestyles of the majority. Particular focus is needed on the transport and energy consumption of one- and two-person adult households, especially those located in rural areas. Other high-impact areas include the shopping behaviour of one- and two-person urban householders and the land use for the homes and gardens of rural households with children. Moving these, as well as less high-consuming, households towards sustainability will require a variety of targeted policies in housing, transport, and land use. n

*Robin Roy is Professor of Design and Environment, and Dr Sally Caird is a Visiting Research Fellow, in the Centre for Technology Strategy at The Open University in Milton Keynes.*

## Notes

- 1 *State of the Environment*. Environment Agency, London, 1999



- 2 K.J. Noorman and T.S. Uiterkamp (Eds): *Green Households? Domestic Consumers, Environment and Sustainability*. Earthscan, London, 1998
- 3 T. Fawcett, K. Lane, B. Boardman *et al.*: *Lower Carbon Futures*. ECI Research Report 23. Environmental Change Institute, University of Oxford, Mar. 2000, p.12
- 4 M. Wackernagel and W. Rees: *Our Ecological Footprint*. New Society Publishers, British Columbia, Canada, 1996
- 5 N. Chambers, C. Simmons, and M. Wackernagel: *Sharing Nature's Interest. Ecological Footprints as an Indicator of Sustainability*. Earthscan, London, 2000. Summarised at [www.bestfootforward.com](http://www.bestfootforward.com)
- 6 J. Loh (Ed.): *Living Planet Report 2000*. World Wide Fund for Nature, Gland, Switzerland, Oct. 2000. Available at [www.panda.org/living planet/](http://www.panda.org/living%20planet/)
- 7 See [www.bestfootforward.com](http://www.bestfootforward.com) – EcoCal may be downloaded from [www.tidybritain.org.uk](http://www.tidybritain.org.uk)
- 8 R. Roy: 'You and the environment'. Theme 1 of T172, *Working with Our Environment: Technology for a Sustainable Future*. The Open University, Milton Keynes, 2000. For details go to [www.open.ac.uk](http://www.open.ac.uk), select 'Courses and Qualifications', and then 'Environment'
- 9 This is based on the EcoCal-derived household footprint capturing about one-third of the total UK footprint per person (C. Simmons and N. Chambers: 'Footprinting UK households'. *Local Environment*, 1998, 3 (3), p. 360) and national UK and globally equitable ('earthshare') bio-capacities of 1.7 and 2 hectares per person, respectively (M. Wackernagel *et al.*: *Ecological Footprint of Nations*. Dec. 1997. Available at [www.ecouncil.ac.cr/rio/focus/report/english/footprint/](http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/)). The sustainable household EF is then reduced to take into account the fact that EcoCal measures in UK, rather than world average, bio-productivity
- 10 C. Crompton, S. Caird, and R. Roy: 'An environmental assessment activity to promote active distance learning and challenge of personal lifestyles and values'. Paper for Sixth International auDES Conference, 'Bridging Minds and Markets. Emerging Issues in

Environmental Education and Employment in Europe', Venice, Italy,  
Apr. 2001

FIGURE 1

*Data entry screen for transport in the computer version of Ecocal*

FIGURE 2

*Average EcoCal scores per person for households with and without  
children (100 ecocal = 1 hectare EF)*

FIGURE 3

*Average EcoCal scores per person for urban/suburban and rural  
households (100 ecocal = 1 hectare EF)*

FIGURE 4

*Average EcoCal scores per person for households of different sizes  
(100 ecocal = 1 hectare EF)*